

WHAT IS CLAIMED IS:

1. A method for setting a knock determination period in a multi-cylinder internal combustion engine which makes a knock determination of each cylinder based on an
5 output signal from a knock sensor during a knock determination period corresponding to each cylinder, the method comprising the step of:
 setting the knock determination period corresponding to a first cylinder in accordance with a fuel injection timing at a second cylinder so as to avoid a case in which noise produced from operation of a fuel injector at the second cylinder rides on the output
10 signal from the knock sensor during the knock determination period corresponding to the first cylinder.
2. The method for setting a knock determination period according to claim 1, wherein the knock determination period corresponding to the first cylinder is set in accordance with
15 the fuel injection timing at the second cylinder so that a timing of noise generation from operation of the fuel injector at the second cylinder does not overlap with the knock determination period corresponding to the first cylinder.
3. The method for setting a knock determination period according to claim 1, wherein
20 the knock determination period corresponding to the first cylinder is set according to the fuel injection timing at the second cylinder when the degree of effect of noise produced by operation of the fuel injector at the second cylinder on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder is large.
- 25 4. A method for setting a fuel injection timing at each cylinder in a multi-cylinder internal combustion engine which makes a knock determination of each cylinder based on
an output signal from a knock sensor during a knock determination period corresponding
to each cylinder, the method comprising the step of:
 setting the fuel injection timing at a second cylinder in accordance with the knock
30 determination period corresponding to a first cylinder so as to avoid a case in which noise produced from operation of a fuel injector at the second cylinder rides on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder.

5. The method for setting a fuel injection timing according to claim 4, wherein the fuel injection timing at the second cylinder is set in accordance with the knock determination period corresponding to the first cylinder so that a timing of noise generation from operation of the fuel injector at the second cylinder does not overlap with the knock determination period corresponding to the first cylinder.

6. The method for setting a fuel injection timing according to claim 4, wherein the knock determination period corresponding to the first cylinder is first changed so as to avoid a case in which noise produced from operation of the fuel injector at the second cylinder rides on the output signal from the knock sensor, and

when the knock determination period corresponding to the first cylinder has been changed to a point beyond which further change is not allowable, the fuel injection timing at the second cylinder is then set according to the knock determination period corresponding to the first cylinder.

7. The method for setting a fuel injection timing according to claim 4, wherein the fuel injection timing at the second cylinder is set according to the knock determination period corresponding to the first cylinder when the degree of effect of noise produced by operation of the fuel injector at the second cylinder on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder is large.

8. A control apparatus for a multi-cylinder internal combustion engine which operates each fuel injector based on a fuel injection timing at each cylinder and makes a knock determination of each cylinder based on an output signal from a knock sensor during a knock determination period corresponding to each cylinder, the control apparatus comprising:

a determining device that determines whether noise produced by operation of the fuel injector at a second cylinder rides on the output signal from the knock sensor during the knock determination period corresponding to a first cylinder based on the fuel injection timing at the second cylinder and the knock determination period corresponding to the first cylinder; and

a setting device that sets the knock determination period corresponding to the first cylinder in accordance with a fuel injection timing at a second cylinder based on a determination result from the determining device so as to avoid a case in which noise

produced from operation of the fuel injector at the second cylinder rides on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder.

5 9. The control apparatus for a multi-cylinder internal combustion engine according to claim 8, wherein the setting device sets the knock determination period corresponding to the first cylinder in accordance with the fuel injection timing at the second cylinder so that a timing of noise generation from operation of the fuel injector at the second cylinder does not overlap with the knock determination period corresponding to the first cylinder.

10 10. The control apparatus for a multi-cylinder internal combustion engine according to claim 8, wherein the setting device sets the knock determination period corresponding to the first cylinder according to the fuel injection timing at the second cylinder when the degree of effect of noise produced by operation of the fuel injector at the second cylinder
15 on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder is large.

11. A control apparatus for a multi-cylinder internal combustion engine which operates each fuel injector based on a fuel injection timing at each cylinder and makes a knock
20 determination of each cylinder based on an output signal from a knock sensor during a knock determination period corresponding to each cylinder, the control apparatus comprising:

a determining device that determines whether noise produced by operation of the fuel injector at a second cylinder rides on the output signal from the knock sensor during the
25 knock determination period corresponding to a first cylinder based on the fuel injection timing at the second cylinder and the knock determination period corresponding to the first cylinder; and

a setting device that sets the fuel injection timing at the second cylinder in accordance with the knock determination period corresponding to the first cylinder based
30 on a determination result from the determining device so as to avoid a case in which noise produced from operation of the fuel injector at the second cylinder rides on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder.

12. The control apparatus for a multi-cylinder internal combustion engine according to claim 11, wherein the setting device sets the fuel injection timing at the second cylinder in accordance with the knock determination period corresponding to the first cylinder so that a timing of noise generation from operation of the fuel injector at the second cylinder does not overlap with the knock determination period corresponding to the first cylinder.

13. The control apparatus for a multi-cylinder internal combustion engine according to claim 11, wherein the setting device firstly changes the knock determination period corresponding to the first cylinder so as to avoid a case in which noise produced from operation of the fuel injector at the second cylinder rides on the output signal from the knock sensor, and

when the knock determination period corresponding to the first cylinder has been changed to a point beyond which further change is not allowable, the setting device then sets the fuel injection timing at the second cylinder according to the knock determination period corresponding to the first cylinder.

14. A control apparatus for a multi-cylinder internal combustion engine which operates each fuel injector based on a fuel injection timing at each cylinder and makes a knock determination of each cylinder based on an output signal from a knock sensor during a knock determination period corresponding to each cylinder, the control apparatus comprising:

a determining device that determines whether noise produced by operation of the fuel injector at a second cylinder rides on the output signal from the knock sensor during the knock determination period corresponding to a first cylinder based on the fuel injection timing at the second cylinder and the knock determination period corresponding to the first cylinder; and

a changing device that changes at least one of the fuel injection timing at the second cylinder and the knock determination period corresponding to the first cylinder based on a determination result from the determining device so as to avoid a case in which noise produced by operation of the fuel injector at the second cylinder rides on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder.

15. The control apparatus for a multi-cylinder internal combustion engine according to claim 14, wherein the changing device changes at least one of the fuel injection timing at the second cylinder and the knock determination period corresponding to the first cylinder based on a determination result from the determining device so as to avoid a case in which the timing of the noise generation and the knock determination period corresponding to the first cylinder overlap.

16. The control apparatus for a multi-cylinder internal combustion engine according to claim 14, wherein the changing device changes the knock determination period first and only changes the fuel injection timing after the knock determination period has been changed to a point beyond which further change is not allowable.

17. The control apparatus for a multi-cylinder internal combustion engine according to claim 14, wherein the changing device changes at least one of the fuel injection timing at the second cylinder and the knock determination period corresponding to the first cylinder when the effect from noise produced by operation of the fuel injector at the second cylinder on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder is large.

18. The method for setting a knock determination period according to claim 2, wherein the knock determination period corresponding to the first cylinder is set according to the fuel injection timing at the second cylinder when the degree of effect of noise produced by operation of the fuel injector at the second cylinder on the output signal from the knock sensor during the knock determination period corresponding to the first cylinder is large.